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(54) DRINK DISPENSING MACHINE

(71) We, GKN SANKEY LIMITED, a British Company of Albert Street Works, Bilston in the County of Stafford, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to machines for dispensing ready-mixed drinks and to methods of mixing the drink ingredients in a cup which is normally thrown away after use.

In present machines which are arranged to dispense hot drinks of different types, or hot and cold drinks, it is usual for each type of drink to be mixed in a separate mixing bowl in the machine and then delivered along pipework from the mixing bowl to a cup at a drink delivery station. In some machines a main ingredient and water are mixed in a mixing bowl and secondary ingredients (e.g. sugar or milk or both) are mixed into the drink in the cup at the drink delivery station. It is essential to keep such machines clean, particularly the mixing bowls and pipework through which the prepared drink passes to the cup, otherwise there is danger of harmful bacteriological growth. In practice, the standard of cleaning cannot always be controlled and as a result cleaning is not always effectively carried out with a consequent danger to health.

It has been proposed to mix a dry ingredient with a hot liquid in the cup in which the drink is subsequently dispensed. The proposal includes adding the liquid to the dry ingredient in the form of a spray which is discharged from the lower end of a rotating member within the cup which is retracted from the cup as the latter is filled. In this proposal, the liquid will fall on top of the dry ingredient and certainly with some types of ingredient, such as those used for making chocolate and soup, the initial drops of liquid which fall on the upper surface of the dry ingredient will form sticky masses and will prevent further liquid dispensed from obtaining access to the dry ingredient. If the cup is filled in this manner, therefore, one is likely to have, particularly with the difficult dry ingredients mentioned above, a layer of dry ingredient at the bottom of the cup, a sticky boundary layer between the dry and the liquid ingredients and a layer of liquid ingredient, unmixed with the solid ingredient, above the boundary layer.

It is an object of one aspect of this invention to provide a method of mixing dry and liquid ingredients which overcomes the above problem.

According to one aspect of the invention, we provide a method of mixing, in a drink dispensing machine, dry and liquid ingredients in a cup of downwardly converging, frusto-conical form, comprising the steps of projecting the liquid ingredient downwardly in a coherent jet into the cup which contains the dry ingredient at the bottom thereof so that the jet impinges on the inner surface of the cup wall at a position above the dry ingredient and flows down said surface and along the bottom of the cup and causing relative rotation between the cup and the jet during projection of the latter in a manner such that said impingement and flow continue to take place during rotation thus to cause mixing of the whole of the dry ingredient with the liquid ingredient.

In the specification and claims the word "ingredient" is used to include "ingredients" in the plural. It will be appreciated that some drinks are made from a single dry ingredient and others from a number of such ingredients. Also, while it is normal to use but a single liquid ingredient, namely water, it is possible to use more than one such ingredient.

The liquid ingredient, upon flowing down the inner surface of the cup wall, flows down the side of the dry ingredient at the bottom of the cup and then starts to flow across the

bottom of the cup and is caused to flow into the ingredient from the bottom thereof. Since the jet must be supplied to the cup at a pressure such as to prevent the ingredient being forced out of the cup, the pressure of the jet is normally insufficient to give it sufficient velocity to travel all the way across the bottom of the cup. Relative rotation is therefore caused to take place between the cup and the jet so that the position of the jet relative to the cup changes and the jet flows across the bottom of the cup from a plurality of different directions, relative to the cup, as the relative rotation takes place thus ensuring that the whole of the dry ingredient is mixed with the liquid ingredient. The relative rotation may take place either by holding the jet in a fixed position and rotating the cup or holding the cup in a fixed position and rotating the jet. The speed of rotation must be such as to enable thorough mixing to take place.

Preferably, the cup is held with its bottom horizontal and the jet is arranged vertically.

When it is desired to have a layer of froth on the top of the drink or the liquid and dry ingredients are difficult to mix all the liquid ingredient will preferably be supplied to the cup in the form of the coherent jet. For other drinks, particularly tea, it is preferred not to have any froth at the top of the drink and it is therefore a further feature of the invention to provide that, after a predetermined quantity of liquid has been projected into the cup in the form of the coherent jet, further liquid is added to the cup in the form of a fan shaped jet, at lower pressure than the coherent jet and at an angle to the vertical so as to suppress the formation of froth on the surface of the drink. Relative rotation takes place between the cup and the fan-shaped jet during operation of the latter.

Thus if the method is used in a machine which is intended for dispensing different drinks, for some drinks, such as coffee with milk and some soups, all the liquid will be added to the cup in the form of the coherent jet thus producing energetic mixing and a layer of froth on the drink. When the machine is set to deliver other drinks, for example tea, the water will initially be fed into the cup in the form of a coherent jet to mix thoroughly with the dry ingredient and then the remainder of the liquid will be added to the cup in the form of the low-pressure, fan-shaped jet, referred to above.

According to another aspect of the invention we provide a drink dispensing machine comprising means to receive a cup of downwardly-converging, frusto-conical form, means to project liquid downwardly in the form of a coherent jet into a cup held in the receiving means, the jet being arranged to impinge on the inner surface of the cup wall above the bottom surface of the cup so as to flow down said surface and along the bottom of the cup, and means to cause relative rotation between the jet and the cup while said impingement and flow continues to take place.

The machine will operate the mixing method described above. If desired, the receiving means may be stationary and means provided to rotate the jet. Alternatively, the jet may be held stationary and means may be provided to rotate the receiving means. It is preferred that, irrespective of whether the coherent jet only or both the coherent and fan-shaped jets are used, relative rotation takes place to the extent of more than one revolution but less than two revolutions during the whole time liquid is being projected into the cup.

Preferably, the projecting means is arranged so that the jet is vertical. There may be second projecting means for projecting the fan shaped, low-pressure jet into the cup where it is a feature of the method and control means may be provided for operating the first and second projecting means in timed relation.

If desired the cup may be filled with liquid at the cup delivery station of the machine i.e. at the station where a user removes the cup from the machine. This is particularly convenient in that it is comparatively easy to extract steam from a cup in this position, thus reducing the difficulties associated with steaming up of the dry ingredients within the machine.

Alternatively, the machine may be arranged so that the cup is filled with the liquid ingredient at a station other than the cup delivery station and means may be provided for moving the filled cup from the other station to the cup delivery station.

Three embodiments of the invention will now be described in detail by way of example with reference to the accompanying diagrammatic drawings in which:—

Figure 1 is a diagram showing the liquid in the form of a coherent jet entering a cup for mixing with the dry ingredient therein;

Figure 2 is a view similar to Figure 1 but showing two projecting means, one for a coherent jet and one for a fan shaped jet; and

Figure 3 is a section similar to Figures 1 and 2 of a third embodiment of the invention.

Referring now to Figure 1, this shows a disposable cup 10 which is of downwardly-converging, frusto-conical form having a downwardly convergent side wall 11, having an inner surface 12, and a bottom 13 having an upper surface 14. The cup is received in means 15 comprising a cup shaped receiver which is mounted on a spindle 16

driven by a unit 17 comprising an electric motor and a geared drive.

Means 18 are provided for protecting downwardly a coherent jet 19 of liquid, normally hot water; a valve 20 is associated with the projecting means to control the flow of liquid therethrough.

The cup has therein, a dry ingredient 21 which rests on the upper surface 14 of the bottom of the cup.

Mixing is carried out by projecting the jet 19 so that it impinges on the inner surface 12 at the location 22 and flows downwardly along said surface as indicated by the arrows and then starts to flow across the upper surface 14, the flow across said surface being from right to left in Figure 1. The liquid is deflected by the surface 14 into the dry ingredient 21 from beneath as indicated by the arrows 23. Normally, the pressure of the water supplied to the projecting means 18 and hence the velocity of the jet 19 is such as not to cause the jet to reach the opposite side of the cup as the jet liquid flows across the surface 14.

During this projection of the liquid into the cup the latter is rotated by the unit 17 through the spindle 16 and the receiving means 15. Preferably, the rotation is at least one revolution but is not more than two revolutions. The unit 17 may be controlled in dependence on the operation of the valve 20 so that rotation takes place so long as water is being supplied from the projecting means 18. Alternatively, separate control means may be provided which control both the valve 20 and the unit 17 in synchronism.

The jet 19 is a coherent jet, that is to say it keeps its generally cylindrical form until it impinges on the surface 12 and then it remains in the form of a comparatively narrow ribbon as it flows under the ingredient 21. Since the initial wetting of the ingredient 21 is from the bottom, no boundary layer is formed between the liquid ingredient and the dry ingredient as in the previous method described above where the liquid was added to the dry ingredient in the form of a spray.

The arrangement shown in Figure 1 is suitable for making drinks such as coffee which requires a layer of froth on the finished drink or which comprise ingredients which are difficult to mix. All the liquid is fed into the cup from the projecting means 18 and due to the coherent nature of the jet, turbulence is caused in the cup which promotes good mixing and which also results in a layer of froth on the upper surface of the drink when the cup has been filled.

As described above, however, it is sometimes desirable to suppress this formation of froth, particularly where the machine is designed to dispense, inter alia, tea with milk where froth is considered a disadvantage. For this purpose, providing that the ingredients are easily miscible, the arrangement shown in Figure 2 may be used.

Parts in Figure 2 which are identical with those in Figure 1 have the same reference numeral. Referring now to Figure 2, the cup is approximately half full of liquid, the upper level of the liquid being indicated at 24. There is means 25 for projecting a coherent jet into the cup 10 and this projecting means 25 is located in a position similar to the projecting means 18 with reference to the cup so that the coherent jet impinges on the surface 12. After the initial discharge from the projecting means 25 has mixed the liquid and dry ingredients accompanied by rotation of the cup, the cup is filled from second projecting means 26 and this projecting means produces a jet which is of fan shape in plan view diverging from the outlet of the projecting means 26. The liquid is supplied to the jet 26 at a pressure lower than that at which liquid is supplied to the projecting means 25 and the projecting means 26 is so angled and arranged that when the cup is substantially filled as indicated by the dotted line 28, the fan shaped jet intersects the surface 28 at approximately the middle of the cup. The cup continues to rotate while the projecting means 26 is in operation. The projecting means 25 and 26 are operated successively by control means, not shown. That is to say when the initial charge of liquid has been delivered by the projecting means 25 this is rendered inoperative and the remaining liquid is supplied through the projecting means 26. The control means may operate a valve indicated at 29 to regulate the flow of liquid to the projecting means 25 and 26.

Referring now to Figure 3 this shows an arrangement in which the cup remains stationary aind the jets are rotated.

The cup and the solid ingredient are indicated by the same reference numerals in Figure 3 as in Figures 1 and 2. There is a first projecting means 30 for projecting liquid into the cup in the form of a coherent jet to impinge on the inner surface of the cup wall as described in relation to Figure 1. This projecting means 30 is mounted on a body 31 which is mounted for rotation about a vertical axis on two coaxial tubes 32 and 33. The upper part of the body 31 is mounted through a rotating sealed joint 34 about the outer tube 32 and the body has an intermediate web 35 which is mounted for rotation about the inner tube 33 by means of a rotating seal 36. Water is supplied to the outer tube from a supply 37 through a valve 38 and the water can flow along the space between the tubes 32 and 33 into the projecting means 30. A valve 39 controls the supply of water to the inner tube 33 and

the lower end of the tube delivers into a projecting means 40 which is mounted on the lower part of the body 31 and is arranged to produce a fan shaped jet at low pressure as described in relation to the projecting means 26 shown in Figure 2. The body 31 has keyed thereto a pulley 41 engaged by a belt 42 driven by an electric motor 43.

In operation, the cup is placed beneath the projecting means in the position shown in Figure 3, the cup being received in a cup holder 44. The valve 38 is then operated to supply water to the first projecting means 30 and the motor 43 is rotated to rotate the body 31, and thus the projecting means 30. The water impinges on the side wall of the cup and flows downwardly and beneath the ingredient 21 as above described thus causing mixing of the liquid and dry ingredients. After a predetermined quantity of water has been projected into the cup the valve 38 is closed and the valve 39 is opened. Water thus passes from the supply 37 through the valve 39 and the inner tube 33 to the projecting means 40 which produces a fan shaped jet which suppresses the formation of foam on the top of the drink as described above. Rotation of the body 31 takes place during operation of both of the projecting means 30 and 40 and the total number of revolutions of the cup is between one and two.

It will be appreciated that the arrangement shown in either Figure 2 or Figure 3 could be used for producing a drink where froth is required at the top of the drink or comprised of ingredients difficult to mix by supplying all the required liquid through the projecting means 25 or 30 as the case may be.

It will be appreciated that, in each of the foregoing examples, as relative rotation takes place between the cup and the projecting means for the coherent jet, the latter continues to impinge upon the inner surface of the wall of the cup at a position such as shown in Figure 1 and continues to flow down the wall of the cup and across the bottom thereof thus promoting complete mixing of the dry ingredient because the liquid approaches the dry ingredient from a plurality of directions. The location of the projecting means 40 is such that upon relative rotation the fan-shaped jet will cover the whole surface of the liquid in the cup.

The pressure of the liquid which forms the coherent jet may be of the order of two to three p.s.i. The jet may impinge in the inner surface of the wall of the cup some $\frac{1}{4}''$ to $\frac{1}{2}''$ above the upper surface of the solid ingredient.

The machine may be arranged to dispense the solid ingredient into the cup at the station where the liquid is added or the ingredient may be dispensed into the cup at another station and the cup then moved to the liquid dispensing station. The liquid dispensing station may be the cup delivery station, i.e. the station at which the cup is delivered to the user. Alternatively, the cup may be filled at another station and then moved, when full, to the cup delivery station.

If the machine is arranged to dispense both hot and cold drinks there may be two sets of projecting means, one for cold water or liquid and the other for hot water or liquid.

It will be seen that the invention provides a simple method and apparatus for mixing liquid and solid ingredients in a drink dispensing machine.

WHAT WE CLAIM IS:—

1. A method of mixing, in a drink-dispensing machine, dry and liquid ingredients in a cup of downwardly converging, frusto-conical form comprising the steps of projecting the liquid ingredient downwardly in a coherent jet into the cup which contains the dry ingredient at the bottom thereof so that the jet impinges on the inner surface of the cup wall at a position above the dry ingredient and flows down said surface and along the bottom of the cup and causing relative rotation between the cup and the jet during the projection of the latter in a manner such that said impingement and flow continues to take place during said rotation thus to cause mixing of the whole of the dry ingredient with the liquid ingredient.

2. A method according to Claim 1 wherein the jet is in a fixed position and the cup is rotated.

3. A method according to Claim 1 wherein the cup is in a fixed position and the jet is rotated.

4. A method according to any preceding claim wherein the jet is projected vertically downwardly and the cup bottom is horizontal.

5. A method according to any preceding claim wherein, after a predetermined quantity of liquid has been projected into the cup in the form of said coherent jet, further liquid is added to the cup in the form of a fan-shaped jet at a lower pressure than the coherent jet and at an angle to the vertical so as to suppress the formation of froth on the surface of the drink, said relative rotation continuing to take place during the projection of the fan-shaped jet.

6. A method according to any preceding claim wherein during the projection of liquid into the cup the relative rotation is more than one revolution but not more than two revolutions.

7. A drink-dispensing machine comprising means to receive a cup of downwardly-converging, frusto-conical form, means to project liquid downwardly in the form of a

coherent jet into a cup held in the receiving means, the jet being arranged to impinge on the inner surface of the cup wall above the bottom surface of the cup so as to flow down said surface and along the bottom of the cup, and means to cause relative rotation between the jet and the cup whilst said impingement and flow continues to take place.

8. Apparatus according to Claim 7 wherein said receiving means is stationary and means are provided to rotate the jet.

9. Apparatus according to Claim 7 wherein said jet is stationary and means is provided to rotate the receiving means.

10. Apparatus according to any of Claims 7 to 9 wherein said projecting means is such that the jet is vertical.

11. Apparatus according to any of Claims 7 to 10 including second projecting means arranged to project liquid into the cup in a fan shaped jet, at a lower pressure than the coherent jet and at an angle to the vertical, and control means for operating the first and second projecting means in sequence.

12. Apparatus according to any one of Claims 7 to 11 wherein the means to cause relative rotation is arranged so that relative rotation of more than one revolution and less than two revolutions takes place during the projection of liquid into the cup.

13. Apparatus according to any of Claims 7 to 12 wherein the receiving means and the projecting means are located at a cup delivery station of the machine.

14. A machine according to any of Claims 7 to 12 wherein the receiving means and the projecting means are at a station other than the cup delivery station of the machine and wherein means is provided for moving the filled cup from said other station to the cup delivery station.

15. A method of mixing, in a drink dispensing machine, dry and liquid ingredients substantially as hereinbefore described with reference to the accompanying drawings.

16. A drink dispensing machine substantially as hereinbefore described with reference to and as shown in Figure 1 of the accompanying drawings.

17. A drink dispensing machine substantially as hereinbefore described with reference to and as shown in Figure 2 of the accompanying drawings.

18. A drink dispensing machine substantially as hereinbefore described with reference to and as shown in Figure 3 of the accompanying drawings.

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1367354 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

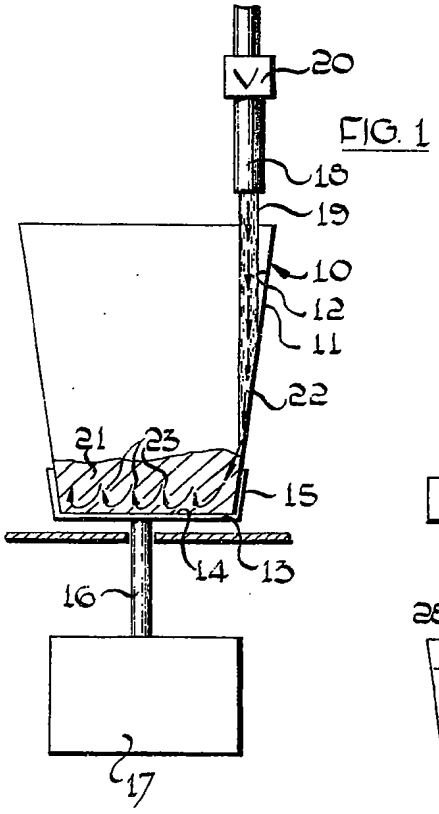

FIG. 1

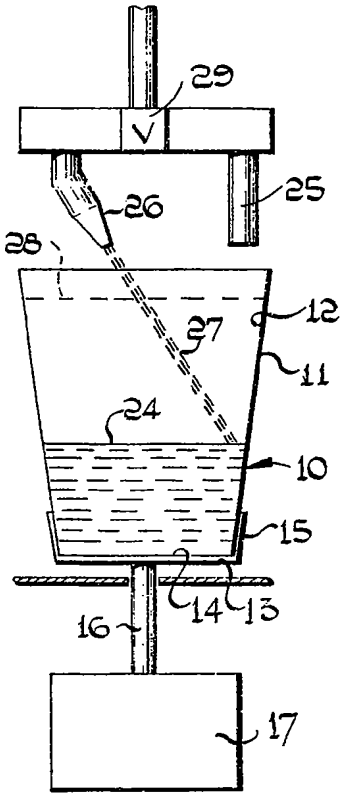

FIG. 2.

1367354 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

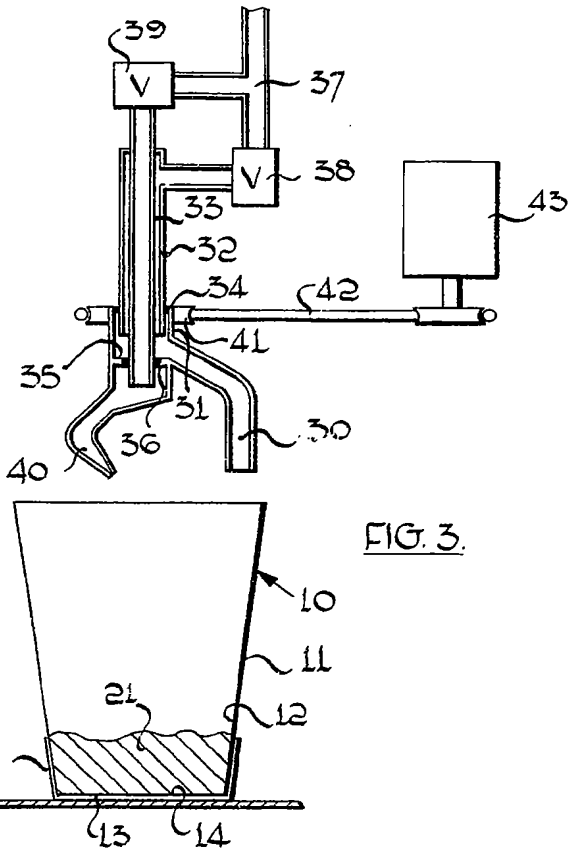

FIG. 3.